which accompanied the storm. 25th, a severe storm formed in Butler county, and swept in a southeasterly direction through Saunders, Lancaster, Cass, Nemaha and Otoe counties, destroying nearly all small grain and beating down the corn. The storm was accompanied by hail, which caused much destruction; at Wahoo, several dwellings were unroofed and all windows facing the west were demolished; a herd of ponies was blown eight miles southward; at Clear Creek, a school-house was demolished, and severe damage was done at Brainard. At Lincoln, the storm was also very severe, most of the orchards and crops being ruined by the large hail-stones. Several persons were injured during the storm, some fatally.

New York: Amsterdam, 17th, a tornado struck the town and did considerable damage to buildings of light construction. The storm-path was sixty feet wide.

New Jersey: Freehold, 4th, 9.20 to 10.15 p. m., a destructive storm occurred over a strip of country south of this place. Hail fell to a depth of two inches, causing damage to the amount of more than one thousand dollars to crops in the immediate vicinity, and several houses were injured. 27th, severe thunder-storm, accompanied by hail, which was mostly jagged, broken ice, some pieces of which measured one and three-eighths inches long and half an inch thick. From 5.50 to 5.57 p. m., the wind reached a velocity of sixty miles per hour. Reports from localities southwest of Freehold state that much damage was done to crops.

North Carolina: Weldon, 4th, a destructive tornado, originating in Southampton county, Virginia, swept through Northhampton and Halifax counties; many houses were blown down and crops were completely ruined. The storm was accompanied by heavy hail-stones of unusual size, which covered the ground to a depth of several inches. At Weldon, several buildings were blown down, and two children were killed by falling timbers. At Garysburg, the "Fetter" academy was blown down. The damage to property by this storm, will amount to several thousand dollars. Kittyhawk, 28th, severe wind storm, telegraph poles were prostrated, and one house was blown down.

Ohio: Sandusky, 18th, severe wind storm, many telegraph poles and trees blown down. 30th, a heavy wind storm occurred over southern Ohio, telegraph wires and trees were prostrated, and growing crops were blown down, corn and oats being broken off by the heavy rain, and several houses were unroofed.

South Carolina: Stateburg, 22d, about three miles north of station, a storm of considerable energy occurred. Much damage was done and several large trees were uprooted.

Tennessee: Nashville, 18th, a severe wind storm, reaching a velocity of fifty-two miles an hour; trees, fences, and awnings were destroyed, and several houses were unroofed. Spring City, Rhea county, a tornado occurred on the 25th; several buildings were blown down.

Texas: Henrietta, 12th, at 7.20 p. m., a severe storm burst over the city, doing considerable damage to buildings. The storm cloud had a whirling motion, and dipped occasionally toward the earth, each dip being attended with great destruction. A house was twisted off its foundation, and many barns and outbuildings were blown away. As the storm cloud only struck the ground at intervals, many houses in its close proximity, were left untouched. The total damage is estimated at $6,000.

Vermont: Woodstock and Strafford, 19th, a severe wind storm passed through these places; many buildings and fences were blown down and trees uprooted. The track of the storm was about fifteen miles in length and from one to five miles in width.

Wisconsin: 27th, a tornado formed near the village of Onalaska and passed through that place at 10.45 a. m.; it then passed in a northeasterly direction through La Crosse, Monroe, and part of Vernon counties. The whole distance traveled was about forty miles, and the width of the track was about eighty rods. Several buildings were unroofed, but the principal damage was done to the crops, which were in some cases completely carried away; great numbers of fruit trees were twisted and broken. The towns of Bangor, Washington, Jefferson and Sheldon were also visited by the storm and sustained more or less damage. One person was seriously injured; the damage to buildings is estimated at $20,000, and the damage to crops cannot be estimated. The observer at La Crosse reports the appearance of the storm cloud, as follows: The storm cloud appeared of a dark blue or nearly black color, followed immediately by a cloud which appeared to be highly illumined and of a yellow color, changing at times to green. After the cloud passed the station the wind changed to north, with moderate breeze and light rain. Five miles from station, rain is reported to have fallen in torrents, many streams were swollen and bridges washed away. At Cashton the storm destroyed five houses and caused great damage to crops. Several persons were injured but none fatally.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for June, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 86.7 per cent. The percentages for the four elements are: Weather, 88.9; Direction of the Wind, 80.9; Temperature, 88.3; Barometer, 88.9 per cent. By geographical districts they are: For New England, 88.4; middle Atlantic states, 90.1; south Atlantic states, 86.7; east Gulf states, 85.7; west Gulf states, 91.9; lower lake region, 85.7; upper lake region, 81.5; Tennessee and the Ohio valley, 88.5; upper Mississippi valley, 84.8; lower Missouri valley, 82.9; northern Pacific coast region, 94.4; middle Pacific coast region, 98.9; southern Pacific coast region, 97.8

There were 160 omissions to predict (37 being due to the absence of reports from the Pacific coast) out of 3,690, or 4.33 per cent. Of the 3,530 predictions that have been made, 109, or 3.08 per cent., are considered to have entirely failed; 92, or 2.60 per cent., were one-fourth verified; 398, or 11.30 per cent., were one-half verified; 365, or 10.33 per cent., were three-fourths verified; 2,566, or 72.69 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

One hundred cautionary signals were displayed during the month of June, of which eighty-two, or 82 per cent were justified by winds of twenty-five miles per hour, at or within one hundred miles of the station. Eight "off-shore" signals were displayed, all of which were fully justified as to direction and velocity. One hundred and eight signals of all kinds were displayed, of which ninety, or 83.3 per cent., were justified. The above does not include signals ordered at sixty-nine display stations, where the velocity is only estimated.

Ninety-five winds of twenty-five miles per hour or over, were reported, for which no signals were ordered.

Fifteen signals were reported late.

NAVIGATION.

STAGE OF WATER IN RIVERS.

In the table on the right-hand of chart iii., are given the highest and lowest stages of water observed at Signal Service stations during the month of June, 1882. In the first column of this table are given the heights of water on the gauge, which have been found dangerous to property at stations:

The Mississippi reached its highest stage at Keokuk on the last of the month, when it was one foot, three inches above the danger-line. At Cairo it was two feet above the danger-line on the 6th of the month, and, on the 17th, it had fallen to thirty-two feet, four inches, the lowest point reached during the month. At Vicksburg, it remained above the danger-line

during the month, the height of water ranging from forty-one feet, six inches to forty-one feet, two inches on the guage.

The Missouri river rose slowly during the month and reached its greatest height between Yankton and Leavenworth from the 27th to 30th. The Ohio, Cumberland and Tennessee rivers were highest on the 2d and 3d of the month, and lowest from the 15th to 28th, except the Tennessee at Chattanooga, where the lowest water, four feet, six inches, occurred on the 13th.

The observer at Nashville, reports the suspension of navigation in the Cumberland river on the 16th. During the past two months, navigation has been better than for any corresponding period during the past six or seven years. The highest water for the year ending June 30th, 1882, fifty-four feet and seven inches, occurred January 22d; the lowest, three feet and three inches, occurred September 12th, 13th, 14th.

FLOODS.

The excessive rainfall of the month has caused local floods in various sections of the country, which were more or less destructive to life and property. The most disastrous flood of of the month was that of Pogue's run, Indianapolis, where ten lives were lost and much property destroyed.

Fort Missoula, Montana, 8th: The river overflowed, completely submerging the bottom-lands; all crops under cultivation were destroyed.

Umatilla, Oregon, 9th and 11th: Severe washouts occurred along portions of the railroad between Umatilla and the Dalles; travel was suspended.

Winnemucca, Nevada, 11th: Five hundred feet of track west of the railroad station, were washed away by heavy rain.

Denver, Colorado, 10th: During a heavy rain storm, the Dry creek overflowed, sweeping away a number of houses, and drowning five persons. Cellars and basements were flooded, and at Golden, several houses were washed away. The damage to property is estimated at $75,000.

Paxton, Illinois, 13th: A heavy rain storm occurred, assuming the proportions of cloud-bursts in some places. The streets were flooded and several buildings were damaged. At Gibson city, Ford county, bridges were washed away and railroad embankments destroyed, impeding travel. The injury to crops in the county is very great.

Winchester, Kentucky, 13th: Very heavy rain fell between 7 and 8 o'clock p. m. The waters of Two Mile creek were so increased in volume as to wash away a cabin containing ten persons, all of whom were drowned. Much damage was done to fencing along the streams in the county.

Indianapolis, Indiana, 14th: Heavy rains caused an overflow in Pogue's run, a small stream running through the city. The Union depot, railroad track, and several streets were flooded, in some parts to a depth of from three to four feet. Many bridges were swept away, and a platform spanning Pogue's run, on which a large number of people had gathered to watch the flood, was suddenly swept away, throwing the occupants into the swift current; many were rescued by bystanders, but others were swept out by the current into the tunnel under Union depot. Ten bodies have been recovered, but the total number drowned is not known.

The cellars of many wholesale houses were flooded, damaging goods to a large amount. The total damage in the city is estimated at $150,000. This flood was the highest since 1865. On the 16th, heavy rains occurred, flooding several streets in the city.

Rushville, Indiana, 14th: A flood equalling that of 1866, caused much damage to the corn and wheat crops. Outside of the town, all the railroad culverts are washed out, and the surrounding country is submerged. Several streets are flooded, and more than 1,000,000 feet of lumber almost ruined.

Five thousand acres of corn are submerged near Lawrenceburg. At Liberty, communication was cut off by the carrying away of bridges, and much damage resulted to crops.

Sydney, Nebraska, 14th: Ground flooded, and people living on low ground and in the valley, were obliged to seek shelter on the roofs of their houses.

Lebanon, Ohio, 14th: Barley and corn-fields submerged, and many railroad bridges in that section damaged. At Camden, the first floors of houses were under water, bridges were injured and great damage to crops resulted from the heavy rains. At Middleton, Eaton and Wilmington, many washouts occurred, and bridges injured, many houses were flooded, and crops greatly damaged.

Fort Scott, Kansas, 17th: The track of the Missouri Pacific railroad, two miles south of Fort Scott, was three feet under water. Heavy rains caused overflows in all the rivers of southern Kansas, doing more or less damage to the wheat crops. Railway travel was delayed.

Cheyenne, Wyoming, 19th: Several streets were flooded by the heavy rain. Cellars and basements were filled with water.

Coleman City, Texas, 20th: The bottom-lands were flooded and a large amount of lumber, wood, and fencing carried away by an overflow of the creek.

Davenport, Iowa, 24th: Serious washouts occurred on the Chicago, Rock Island and Pacific railroad, a train was wrecked by having the earth washed from under the ties. The loss of bridges in Fremont county, will exceed $15,000.

Hannibal, Missouri, 28th: Bear Creek overflowed, sweeping 500,000 feet of lumber into the Mississippi river. Several houses were also swept away, and many bridges damaged. Two railroads have been abandoned, owing to destruction of bridges.

Minneapolis, Minnesota, 23d: A heavy rain storm at Otwatonna caused great damage to crops, and washed away much farm machinery.

Oregon, Illinois, 30th: Severe rain storm, flooding the flats, and driving families from their homes, many bridges were damaged, and barns and outbuildings floated away.

Lafayette, Indiana, 30th: A heavy rain washed away the street crossings, fences, and filled the cellars and basement of houses. The damage to property amounts to several thousand dollars.

Morrison, Illinois, 30th: Rock Creek near Malvern, rose eight feet in one hour. Bridges and mills were washed away and much stock drowned. Two men were drowned at Empire.

Elmira, 25th: From 1.20 to 4 p. m., a heavy rain storm washed away bridges, fences, and did much damage.

Patterson, New Jersey, 19th: During a heavy rain, sewers were unable to contain the water, street and cellars were flooded in all parts of the city.

Variety Mills, Virginia, 23d: 3 to 5 p. m., during heavy rain, creeks overflowed and caused much damage to wheat and corn.

At Keokuk, Iowa, the Mississippi river has been above the danger line throughout the month. On the 28th, the Des Moines levee was broken, flooding a large tract of farming land under cultivation; the railroad tracks were submerged and much damage was done.

TIDAL WAVE.

A most remarkable phenomenon of this character occurred in lake Erie at Cleveland on the 23d, concerning which the Signal Service observer at that station reports as follows: About 6 a. m. a dark, angry-looking cloud was observed over the lake, moving rapidly toward the shore. When first noticed this cloud was of moderate proportions, but as it advanced it extended in width and increased in height above its base, which remained at nearly the same elevation. It had the appearance of a heavy thunder cloud of an unusually low height, the lower part of which resembled a heavy curtain of grayish color hanging over the water and nearly parallel with the shore; above this, a contorted mass of cloud, whirling and writhing within itself, showed the existence of a disturbance of great violence. At 6.20 a. m., at distance of about half a mile from the shore, was noticed an immense wave directly under the curtain-like cloud, moving silently inward with terrific velocity, without crest until it reached the shallow water near the shore, when a white foaming crest formed. A moment later it broke upon the shore

with a deafening sound. When the wave entered the shallow water the cloud passed overhead, while scarcely more than a gentle breeze was felt. This inrushing of the water was followed by two recoiling waves about one hundred feet apart, which could be seen for a long distance moving back into the lake with about the same velocity as an ordinary storm wave. Following this, the water, which seemed piled up along the shore, soon subsided. Preceding this phenomenon, the lake was unusually calm. At 6.35 a. m., a brisk shower set in lasting fifteen minutes. No peculiar atmospheric conditions preceded the disturbance; the maximum wind velocity in this city for the eight hours preceding 7 a. m. did not exceed ten miles per hour, but the wind blew fiercely south of the city, and at the mouth of the river vessels parted the lines. Hundreds of fish were cast ashore, and the fires in the Lake Erie rolling-mills were put out. A scow loaded with sand at the breakwater was landed high and dry upon the shore. Some iron rails, twenty-eight feet long, piled near the depot, were lifted and scattered in every direction. The wave broke completely over the railroad tracks along the shore, covering them to a depth of several feet and submerging the Erie street pier. On this pier, the flooring of which is eight feet above the level of the lake, a boat-house was wrecked and a man washed overboard and drowned. The damage to property along the shore is roughly estimated at $30,000. The wave is known to have extended from a point five miles east of this city to Fairport, a distance of thirty-five miles. Steamboat men who arrived during the morning report the occurrence of a short squall and sudden movement of the water off this port, of which no especial notice was taken at the time.

The Signal Service observer at Erie reports that between 1.30 and 2.00 p. m., the tidal wave was also slightly felt at that city; the water suddenly rushed over the piers, floating away lumber, etc.

A similar tidal wave occurred on Lake Erie May 10, 1823 at Otter creek, on the Canada shore, and at Kettle creek, twenty miles distant, which attained a height of nine feet. In 1830, three waves were observed at Madison creek, Ohio, the first rising fifteen or twenty feet. In 1844 or 1845 a wave came into Euclid creek, fifteen feet in height. On June 15, 1872, the water rose twenty-six inches at Charlotte, on the mouth of the Genesee river. On November 18, 1845, the water at Cleveland suddenly fell two and eight-tenths feet during a high wind from the southwest, and, according to the "Toledo Blade," a change of ten feet in the waters of Lake Erie took place December 5, 1856. In May, 1855, a similar phenomenon was observed on Lake Seneca, the water continuing to rise and fall from sixteen and a half inches to two feet during two days. Old residents of Conneaut, Ohio, remember a sudden rise of four feet in the lake, covering the orchards upon the flats for several weeks and compelling the people to gather their fruit in boats. Similar agitations of the waters occurred on Lake Geneva, in Switzerland. In 1841, at Berne, the water receded to such an extent as to leave the ships that were at anchor on bare ground.

Like phenomena have occurred on Lake Superior. In 1789, opposite Isle Royal, the water suddenly fell four feet, returning with a great rush. In 1834 the waters above Sault Rapids suddenly receded, and in half an hour returned with great velocity. In August, 1845, an enormous wave, twenty feet in height, was observed between Copper Harbor and Eagle River, rolling towards the shore. In 1847, 1848, and 1849, sudden rises and falls of the waters were repeatedly observed to precede or follow storms on the lake. In 1851, during a perfect calm, the water suddenly rose one foot and three inches, and during another, two and one-half feet. On July 17, 1855, extreme fluctuations on Lake Superior took place between nine in the morning and four in the evening. Other remarkable phenomena of a like nature occurred at the mouth of the Sault Saint Marie, on Lake Huron, in 1856, and at the head of Lake Erie, at Monroe, Michigan, in 1844.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the right-hand of chart ii. In the first column of the table is given the maximum temperature observed during the month; and in the second column the minimum temperature observed during the same period.

The following table gives the highest and lowest temperature of water at the several stations, with the range of water temperature, mean temperature of the air at the station, and the depth of water at which the observations were taken. It will be seen that the greatest ranges are: 22°.4 at Thatcher's Island, 22° at Toledo, 21° at Grand Haven, 19°.3 at Alpena, and 19° at Chincoteague. The smallest are: 4°.4 at Key West and 5°.4 at Eastport.

Temperature of Water for June, 1882.

STATION.	Temperature at bottom.		Range.	Average depth in feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
	°	°	°	ft. in.	°
Atlantic City	71.5	55.3	16.2	6 7	66.6
Alpena	69.8	50.5	19.3	12 0	57.8
Augusta	88.3	78.	10.8	6 6	78.6
Baltimore	79.5	68.	11.5	9 9	74.0
Boston	66.5	51.	15.5	25 0	65.9
Buffalo	71.	54.3	16.7	10 5	62.4
Burlington					
Cedar Keys	87.	74.	13.0	9 7	79.9
Charleston	84.1	75.4	8.7	41 5	79.3
*Chicago	67.	64.	3.0	7 9	63.6
Chincoteague	83.	64.	19.0	6 0	69.7
Cleveland	72.2	56.1	16.1	14 0	66.2
Detroit	70.	54.	16.0	24 4	67.2
Duluth	62.	45.	17.0	14 4	57.9
Delaware Breakwater	69.4	57.	12.4	8 2	67.9
Eastport	44.2	38.8	5.4	17 3	56.2
Escanaba	67.	49.	18.0	15 0	59.5
Galveston	85.	69.	16.0	14 8	81.3
Grand Haven	72.5	51.5	21.0	19 0	62.9
Indianola	86.3	76.4	9.9	9 4	81.1
Jacksonville	87.	77.	10.0	18 0	91.1
Key West	89.1	84.7	4.4	16 8	84.3
Marquette	52.9	45.9	7.0	10 11	56.5
Milwaukee	61.5	44.6	16.9	8 0	61.4
Mobile	86.3	74.5	11.8	15 11	81.3
New Haven	75.2	58.	17.2	15 2	66.2
New London	63.	56.	8.0	12 8	65.9
Newport	67.5	52.	15.5	11 0	64.2
New York	73.	59.	14.0	22 11	66.1
New Shoreham	63.5	51.	12.5	8 7	66.4
Norfolk	83.	69.	14.0	17 2	75.2
Pensacola	83.8	74.5	9.3	17 10	79.8
Portland, Me	57.6	45.	12.6	19 0	65.1
Portland, Oreg	64.5	53.4	11.1	82 3	62.7
Port Eads					
Provincetown	68.5	53.	15.5	14 0	64.1
Punta Rassa	90.5	80.1	10.4	11 9	80.5
Sandusky	76.4	59.3	17.1	10 0	67.0
Sandy Hook	67.2	55.	12.2	1 5	68.7
San Francisco	61.5	55.9	5.6	28 7	57.0
Savannah	87.4	76.8	10.6	12 2	80.3
Smithville	83.	74.	9.0	10 0	76.9
Thatcher's Island	67.4	45.	22.4	7 0	61.7
Toledo	81.	59.	22.0	11 8	68.1
Wilmington	85.5	75.	10.5	13 0	76.9

*Observations wanting, from 1st to 26th, inclusive.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most extensive display of the month occurred on the evening of the 14th. It was reported by numerous stations throughout the northern part of the United States. The line of observation extended from Mount Washington, New Hampshire, to Dayton, Washington territory. The most southerly stations at which it was observed, were Springfield, Illinois, and New Corydon, Indiana.

On the summit of Mount Washington, it is reported to have been a faint display, lasting from 8.20 p. m., to the morning of the 15th. Buffalo, from 11.15 p. m., to 1.40 a. m., of the 15th, faint aurora, consisting of a whitish light, seen through the broken clouds. Davenport, Iowa, 11 p. m., until midnight, consisting of a diffuse yellow light, extending to an altitude of 30°. Saint Paul, 10.20 p. m., aurora consisting of a diffuse light of a pale straw color, with dark segment beneath. At 11 p. m., vertical beams beams shot upward to an altitude of